



CHAIRMAN OF THE JOINT CHIEFS OF STAFF INSTRUCTION

J2

DISTRIBUTION: A, B, C, J

CJCSI 3505.01

31 August 2006

TARGET COORDINATE MENSURATION CERTIFICATION

References:

- a. DODD 5105.60, 11 October 1996, "National Imagery and Mapping Agency (U)"
- b. Joint Publication 2-03, 31 March 1999, "Joint Tactics, Techniques, and Procedures for Geospatial Information and Services Support to Joint Operations"

1. Purpose. This instruction establishes policy for individual and organizational target coordinate mensuration certification for unilateral and joint operations of the US Armed Forces and for combined multinational operations with the military forces of allied nations.
2. Cancellation. None.
3. Applicability. This instruction applies to the combatant commands, Services, Defense agencies, and Joint Staff engaged in producing and archiving precise coordinates for coalition strike operations. Personnel, such as Joint Terminal Attack Controllers, Forward Observers, and fire support personnel, conducting tactical coordinate mensuration, for other than deliberate/planned targets, are excepted from this instruction.
4. Policy
 - a. The targeting process requires due diligence in all facets to include target coordinate mensuration. Due diligence, in the case of mensuration, means ensuring those individuals performing this task are properly trained and certified to established standards and sufficiently demonstrate their proficiency and adherence to approved methods on a continuing basis. It is the policy of the Department of Defense that personnel performing these tasks meet the requirements set forth in this instruction.

b. As functional manager for geospatial-intelligence, the National Geospatial-Intelligence Agency (NGA) is charged with establishing target coordinate mensuration and certification standards, as well as work center accreditation criteria, for the Department of Defense and Intelligence Community. NGA will publish these certification standards, accreditation criteria, and common training support materials on their secure Web sites for community use.

c. The Services, per title 10 USC, will develop and provide NGA-accredited training to meet their requirements for personnel to be certified in target coordinate mensuration. The Services will also administer a continual certification process, approved by NGA, to ensure proficiency.

d. Combatant commands and Defense agencies may assist the Services by administering a continual certification process, approved by NGA, to ensure proficiency of permanently assigned personnel.

e. Compliance with this instruction will be determined by a review process undertaken jointly by NGA and Joint Chiefs of Staff/J-2 Targets (JCS/J2T).

f. Allies and coalition partners may submit training and certification processes and target coordinate mensuration tools for NGA review, through JCS/J2T, to ensure uniform standards for target coordinate data used during coalition operations.

g. Joint certification is required for individuals providing target coordinate data to the Modernized Integrated Database (MIDB) Target Detail Tables. It is of utmost importance that the integrity of the targeting database be maintained to allow rapid execution of operational plans.

h. NGA-validated coordinate mensuration tools and techniques will be used to conduct the training and certification specified in this instruction. NGA will maintain a listing of validated coordinate mensuration tools and techniques on their secure Web sites for community use.

5. Definitions. See the Glossary.

6. Responsibilities

a. NGA. Establish and maintain the minimum standards for required training and certification. NGA will review and accredit uniformed Service, Defense agencies, and command training and certification processes for target coordinate mensuration. NGA will perform a re-accreditation for the training and certification processes every 4 years or sooner if warranted by circumstances. Upon request, NGA will review and accredit allied training and

certification processes. NGA, in coordination with JCS/J2T, will provide a periodic review of data produced by Services, Defense agencies, and commands contained in the target detail tables in the MIDB and will provide additional reviews as changes to processes dictate. Upon request from a Service, NGA will provide validation of Service provided coordinate mensuration tools used to support precision targeting.

b. Services. Provide prerequisite training in target coordinate mensuration to all personnel assigned to target coordinate mensuration duties. Training must include the core elements as described in Enclosure A. Services will establish an NGA-accredited certification process in accordance with the requirements outlined in Enclosures A through E and designate a responsible organization to report certification results to JCS/J2T for maintenance in the joint registry (ref para 6e below). Services will provide mensuration tools that have been validated by NGA for use in target coordinate mensuration and will ensure only certified individuals can transact target coordinate data with MIDB using their producer codes.

c. Combatant commands and Defense agencies. Combatant commands and Defense agencies will, in the absence of a Service process, ensure proficiency and certification requirements are met for the duration of an individual's assignment. Combatant commands and Defense agencies will develop an NGA-accredited certification process to meet this requirement. Combatant commands and Defense agencies will also ensure only certified individuals can transact targeting data with MIDB using their producer codes and will designate a responsible organization to provide JCS/J2T updates to the joint registry. The Defense Intelligence Agency (DIA) will ensure appropriate business rules are enforced for database transactions.

d. Allies. When Allies partner with US forces in combined operations and are responsible for providing target coordinate data to US forces, the appropriate combatant command will ensure that the Allies use NGA-validated tools and their operators, assigned to support targeting operations, meet NGA standards. The combatant command will also ensure only certified individuals can transact target coordinate data with the MIDB using the Allies' producer codes. JCS/J2T will coordinate with the Allies to report required information on certified Allied operators to the joint registry.

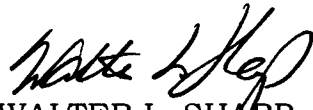
e. JCS/J2T. Maintain the joint registry of certified operators and provide secure access via Joint Worldwide Intelligence Communications Systems (JWICS) and the Secret Internet Protocol Routing Network (SIPRNET) to all participants. The joint registry will contain the following certification data: name, Service, certifying organization, organization currently assigned, certified skills, tool and version, certification data, and expiration date.

7. Summary of Changes. None.

8. Releasability. This instruction is approved for public release; distribution is unlimited. DOD components (to include the combatant commands), other federal agencies, and the public may obtain copies of this instruction through the Internet from the CJCS Directives Home Page--
http://www.dtic.mil/cjcs_directives. Copies are also available through the Government Printing Office on the Joint Electronic Library CD-ROM.

9. Effective Date. This instruction is effective upon receipt.

For the Chairman of the Joint Chiefs of Staff:



WALTER L. SHARP
Lieutenant General, USA
Director, Joint Staff

Enclosures:

- A - Formal Training Requirements
- B - Individual Certification Requirements
- C - Mensuration Certification Checklist
- D - Work Center Accreditation Requirements
- E - Work Center Process Requirements
- GL - Glossary of Acronyms and Terms and Definitions

LIST OF EFFECTIVE PAGES

The following is a list of effective pages for. Use this list to verify the currency and completeness of the document. An "O" indicates a page in the original document.

PAGE	CHANGE
1 thru 4	O
i thru iv	O
A-1 thru A-3	O
B-1 thru B-2	O
C-1 thru C-2	O
D-1	O
E-1 thru E-2	O
GL-1 thru GL-6	O

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RECORD OF CHANGES

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ENCLOSURE A
FORMAL TRAINING REQUIREMENTS

1. Photo Interpretation

a. Demonstrate knowledge of physical and cultural features using imagery types from national, commercial, and tactical sources.

b. Demonstrate how to locate and identify commonly encountered physical and cultural features using all three sources of imagery.

2. Precise Positioning Background

a. Projections, coordinate systems, and datums.

(1) Demonstrate knowledge of map and chart projections.

(2) Demonstrate knowledge of horizontal and vertical datums.

(3) Identify and convert datum types, i.e., local to World Geodetic System (WGS), mean sea level (MSL) to height above ellipsoid (HAE).

(4) Demonstrate knowledge of Cartesian, Geodetic, Universal Transverse Mercator (UTM) and Military Grid Reference System (MGRS) coordinate systems.

(5) Identify and transform coordinate systems using Joint Mapping Tool Kit (JMTK), Geospatial Translator (GEOTRANS), or other NGA-approved transformation tools.

(6) Demonstrate distance measurements using standard DOD projections.

b. Photogrammetric principles (monoscopic and stereo imagery).

(1) Demonstrate knowledge of optics, aerial photography, imaging sensors, positioning, stereo imaging, and exploitation.

(2) Demonstrate knowledge of the strengths and weaknesses of stereo positioning, monoscopic mensuration intersecting with a digital elevation model, and mixed sensor geopositioning.

- c. Sources to include national, tactical, and commercial.
 - (1) Demonstrate knowledge of all sensor types.
 - (2) Demonstrate knowledge of strengths and weaknesses of each source type and apply appropriate source to issue.
- d. Digital Point Positioning Database (DPPDB).
 - (1) Demonstrate knowledge of DPPDB media, coverage, product currency, imagery characteristics, segmentation, and accuracies.
 - (2) Demonstrate selection of latest and best DPPDB for selected point.
- e. Multi-Image Geopositioning.
 - (1) Demonstrate knowledge of source selection techniques.
 - (2) Demonstrate directory maintenance, source selection, and monoscopic mensuration.
- f. Overview of precision mensuration tools (stereo).
 - (1) Demonstrate knowledge of tool capabilities for precise positioning, distances, and heights.
 - (2) Demonstrate target mensuration to include horizontal distances and feature height.
- g. Overview of stereo image tying for indirect mensuration, if applicable for coordinate mensuration tool.
 - (1) Demonstrate knowledge of image registration techniques.
 - (2) Demonstrate tie point selection and subsequent target measurement.
- h. Accuracies, Precision and Errors.
 - (1) Demonstrate knowledge of accuracy, precision, and error definitions and types, to include circular error (CE), circular error probable (CEP), linear error (LE), linear error probable (LEP), and target location error (TLE).
 - (2) Demonstrate understanding of accuracy and error types.

i. Error Propagation, Residuals, and Statistics.

(1) Demonstrate knowledge of mensuration tool error propagation, differences, standard deviations, means, variances, population samples, and frequencies.

(2) Demonstrate the ability to interpret the processed results, compare measurements, and analyze statistical data associated with target measurement.

j. Demonstrate knowledge of how geo-coordinate data affects delivery of precision-guided and coordinate-seeking munitions.

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ENCLOSURE B

INDIVIDUAL CERTIFICATION REQUIREMENTS

1. Operator must reach an acceptable level of proficiency prior to undergoing a certification review.
 - a. Work must be subject to appropriate quality review process.
 - b. Must work under guidance of certified and experienced operator.
 - c. Must be approved and nominated by certified operator and/or supervisor to undergo formal certification.
2. An individual nominated and/or approved for certification must demonstrate proficiency in all aspects of coordinate mensuration as defined in Enclosure C.
3. Reviewer requires all operators to explain and demonstrate the target materials process, point mensuration procedure, and quality review.
 - a. Operator must demonstrate correct use of the software application and accurately measure the points requested by the reviewer.
 - b. Operator must be reviewed using a mix of mensuration scenarios that include situations, such as high relief and restricted look angle.
 - c. Operator must demonstrate proper measurement of ground and feature heights.
 - d. Operator may be queried on production planning, database query, source selection, imagery formats, coordinate systems and transformations, image enhancements, point measurement techniques (including point transfer), database population, and quality control.
4. Reviewer completes a checklist for the above queries and operator derived data (see Enclosure C). This checklist indicates how well the operator understands and demonstrates the point measurement process. The mensurated data will be compared to community means data to check accuracy.

a. Deltas (linear vector distances) will be computed between the derived coordinates and the community means data for those points. Measurements should agree within 10 feet horizontally and vertically.

b. The reviewer performs an objective analysis of each operator and issues a summary report with conclusions.

5. Upon successful completion of the certification process, the analyst's name will be submitted to JCS/J2T for maintenance within the joint registry.

a. Information will contain the name of the certified individual, Service affiliation, certifying organization, organization currently assigned, certified skills, tool and version, date of certification, and date of expiration. Each individual will be issued certificate of same information; certificate will be maintained in service member's training record.

b. The registry will initially be available on JCS/J2T's SIPRNET Web site, with follow-on accessibility on its JWICS and STONEGHOST sites. The JCS/J2T SIPRNET address is: http://delphis.dia.smil.mil/intel/j2/j2t/J2T_page.html

6. Maintaining Proficiency

a. Work Center will provide experience for required skills on a monthly basis to assure individual proficiency.

b. Operators must demonstrate proficiency on a monthly basis to certified work center personnel using an NGA-trusted dataset.

7. Re-Certification

a. Operators with a proficiency gap of more than 1 month but less than 12 months must be re-assessed to determine proficiency by assigned organization and provided any necessary remedial training prior to resuming mensuration duties.

b. Operators with gaps in proficiency greater than 12 months must be re-certified.

ENCLOSURE C

MENSURATION CERTIFICATION CHECKLIST

1. Tool Overview

a. Use and functions.

(1) Demonstrate knowledge of fundamental applications and operations.

(2) Demonstrate knowledge of tool capabilities for precise positioning, measuring distances, and determining heights.

b. Demonstrate software familiarity and basic functionality.

c. Connections to other applications, import and export.

(1) Demonstrate knowledge of essential applications to ensure an effective process.

(2) Demonstrate import of target reference data and export of mensurated target data without corruption.

d. Imagery import, enhancements, magnification, rotation, and parallax.

(1) Demonstrate knowledge of image importation and manipulation.

(2) Demonstrate imagery import image sharpening, proper rotation and magnification, and removal of parallax.

2. Tool Capabilities and Horizontal and Vertical Measurements

a. Demonstrate knowledge of measurement rulers.

b. Demonstrate feature measurement using application rulers.

c. Demonstrate target mensuration to include horizontal distances and feature height.

3. Mensuration Techniques

a. Demonstrate knowledge of how to correctly derive positional location of targets on DPPDB imagery.

- b. Demonstrate correct and accurate measurement of targets on DPPDB imagery.

4. Interpretation of Mensurated Data

- a. Demonstrate knowledge of geo-coordinate data interpretation, to include coordinates, elevation, and associated accuracies.

- b. Demonstrate ability to identify problems with derived data.

5. Non-Traditional Source Measurement

- a. Indirect measurement registration.

- (1) Demonstrate knowledge of tie point selection, indirect measurement, and post-mensuration data interpretation.

- (2) Demonstrate tie point selection and measurement, target mensuration, and final data interpretation for national, commercial, and tactical imagery.

- b. Multi-image mensuration.

- (1) Demonstrate knowledge of imagery library search, source import and selection, target mensuration, and final data interpretation.

- (2) Demonstrate imagery search, population imagery directory, source selection, target mensuration, and geo-coordinate interpretation.

ENCLOSURE D

WORK CENTER ACCREDITATION REQUIREMENTS

1. A work center that provides targeting data to MIDB, weapon databases, or otherwise produces precision coordinates for coordinate-seeking weapons must employ an NGA accredited process.
2. The work center must possess validated tools and demonstrate an end-to-end process flow to include a quality control procedure that ensures data integrity throughout the work center process.
3. Transfers of data between mensuration tools, databases, and image products should be machine-to-machine transactions. If any of the data handoffs are manual, a rigorous quality review process must be in place, requiring a minimum of two independent reviews.
4. An overall quality review process must be demonstrated to ensure the precise point requested is correctly mensurated, passed to MIDB, and identified on the Joint Desired Point of Impact (JDPI) graphic.
5. Deficiencies in the requesting organization's processes, if any, will be identified and corrective actions suggested to the appropriate management level. After corrective actions are implemented, a reassessment will be accomplished.
6. NGA will re-accredit Service, command, and Defense agency certification programs every 4 years to include a re-evaluation of training, certification, proficiency, and documentation processes.
7. If the work center has a significant change in process, such as a new mensuration tool, a new database technique or program, or a new graphic production system, then a re-accreditation by NGA is required.
8. NGA will perform program reviews every 2 years consisting of verification that no significant change has occurred to an accredited process, that data reviews have occurred, and that a satisfactory level of performance has continued.

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ENCLOSURE E

WORK CENTER PROCESS REQUIREMENTS

1. Incoming Requests
 - a. Reviewed for understanding and completeness.
 - b. De-conflicted with production requirements, in-work requests for information (RFIs), MIDB, and electronic target folders.
2. Search for Source (Mensuration, Graphic)
 - a. Best accuracy and/or portrayal for mensuration.
 - b. Latest and/or best portrayal for image product.
3. Mensuration
 - a. Direct mensuration using stereo, DPPDB, or multi-image geopositioning.
 - b. Indirect mensuration registering or tying stereo or DPPDB to any type of imagery source; national, tactical, or commercial.
 - c. Recording of both ground and top elevations of targets.
 - d. Quality control of data and/or validation of target point depiction.
4. Pass Data to MIDB to Store Target Coordinate Information.
5. JDPI Graphic Creation
 - a. Import of data into graphic template.
 - b. Import of image into graphic template.
 - c. Annotation of target points.
 - d. Quality control of data, image, and annotations before sending graphic to customer.
6. JDPI Graphic Export to Requestors

- a. Disseminate as required by customer.
- b. Post graphics on Web sites, FTP site and/or place in target folder or imagery product library.

7. Final Quality Review of Completed Data and Posted Image Products

GLOSSARY

PART I--ACRONYMS

API	Application Programmer Interface
CE	circular error
CEP	circular error probable
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
COE	common operating environment
DIA	Defense Intelligence Agency
DOD	Department of Defense
DPPDB	Digital Point Positioning Database
FTP	File Transfer Protocol
GEOTRANS	Geographic Translator
GI&S	Geospatial Information and Services
GPS	Global Positioning System
HAE	height above ellipsoid
JDPI	Joint Desired Point of Impact
JMTK	Joint Mapping Tool Kit
JTAC	Joint Terminal Air Controller
LE	linear error
LEP	linear error probable
MGRS	Military Grid Reference System
MIDB	Modernized Integrated Database
MSL	mean sea level
NATO	North Atlantic Treaty Organization
NGA	National Geospatial-Intelligence Agency
RFI	request for information
SIPRNET	SECRET Internet Protocol Router Network
TLE	target location error

UTM	Universal Transverse Mercator
USC	United States Code
WGS	World Geodetic System

PART II—TERMS AND DEFINITIONS

accreditation – The formal declaration to operate at an acceptable level of risk, based on the implementation of an approved set of technical, instructional, managerial, and procedural safeguards.

circular error (CE) – The geospatial position horizontal accuracy, expressed in feet or meters at 90 percent probability. It is probable that 90 percent of the time the measurement will fall inside a circle about the estimated point with a radius equal to the CE90.

circular error probable (CEP) – The geospatial position horizontal accuracy, expressed in feet or meters at 50 percent probability. Some weapon systems use circular measures of absolute and relative accuracy at 50 percent probability that reflect the intended uses of these systems. CEP, when applied to a weapon delivery, is the radius of a circle around the target within which, statistically, 50 percent of the weapons would fall. For a normal distribution, CE and CEP are directly related ($CE = 1.8227 \times CEP$).

certification – A comprehensive evaluation of a process that establishes compliance with a set of standards.

error propagation – The process of evaluating the accuracy of computed values as a function of accuracy in the input values. In the case of target coordinates, error propagation is the assignment of accuracy estimates for ground point, based on the accuracy of the input variables. These accuracy values are carried forward or propagated into subsequent processes.

geo-coordinate – A particular 3-dimensional location on the earth defined by horizontal and vertical datums.

Geographic Translator (GEOTRANS) - An application program that allows converting geographic coordinates among a wide variety of coordinate systems, map projections, and datums. GEOTRANS runs in Microsoft Windows (95 and NT) and UNIX Motif environments.

height above ellipsoid (HAE) – The distance above or below the ellipsoid (plus or minus), which is a flattened sphere with a mathematically defined regular surface used to represent the geometric model of the Earth.

Joint Mapping Tool Kit (JMTK) - A collection of Application Programmer Interfaces (APIs) that support the military services' Geospatial

Information and Services (GI&S) functionality. Specifically, these APIs enable mission applications to interface with the common operating environment GI&S component. NGA developed the JMTK to satisfy the DOD services' common GI&S requirements.

linear error (LE) – The geospatial position vertical accuracy, traditionally measured in feet or meters at 90 percent probability.

linear error probable (LEP) – The geospatial position vertical accuracy, traditionally measured in feet or meters at 50 percent probability. For a normal distribution, LE and LEP are directly related ($LE = 2.4387 \times LEP$).

mean sea level (MSL) – MSL is usually described as a tidal datum that is the arithmetic mean of hourly water elevations observed over a specific 19-year cycle. This definition averages out tidal highs and lows caused by the changing effects of the gravitational forces from the moon and sun. MSL is defined as the zero elevation for a local area. The zero surface referenced by elevation is called a vertical datum.

mensuration – The process of measurement of a feature or location on the earth to determine an absolute latitude, longitude, and height. For targeting applications, the errors inherent in both the source for measurement as well as the measurement processes must be understood and reported.

Military Grid Reference System (MGRS) – This grid system is normally created by superimposing a metric, square grid on a Universal Transverse Mercator or universal polar stereographic projection. The grid is printed on military maps and certain air and naval charts that include land areas. This position reference system provides a common system for the positioning of points on land or coastal areas and for the rapid computation of direction and distances between points.

target location error (TLE) – The difference between the actual location of the target and the expected location. Understanding and predicting TLE is particularly crucial to autonomous weapons deployment because of low combined weapons effectiveness.

validation – The process of determining the degree to which a model is an accurate representation of the real world from the perspective of the intended uses of the model. It is also the process of determining that a model implementation accurately represents the developer's conceptual description and specifications.

work center – A Service, command, or agency component engaged in target material production, including mensuration. A work center will typically control its own production assets and processes to include standard operating procedures, on the job training, and quality processes.

World Geodetic System 1984 (WGS-84) – An earth-centered, earth-fixed worldwide geodetic datum and reference system based on a determination of the earth's parameters and gravity field. NGA developed the system as the standard geographic reference system for use within the Department of Defense. NGA uses WGS-84 in its production of maps and charts. The North Atlantic Treaty Organization and the allied nations have approved, in principle, the use of the WGS-84 for geospatial information purposes. It provides uniform datum and reference system information for use in joint and multinational operations. In addition, global positioning system, which is a navigation tool for air, land, sea, and space operations within the Department of Defense, is designed to work in WGS-84.

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